Metals by Inductively Coupled Plasma (ICP) Atomic Emission Spectroscopy (AES)
EPA Method 200.7

Table 1A. Summary of Holding Times and Preservation for Metals

Analytical Parameter [a]	Technical and Contract Holding Times	Preservation
Metals in water	Technical: 180 days from date of collection; Contract: 35 days from sample receipt at laboratory	pH <2 (with nitric acid)
Metals in soil	Technical: 180 days from date of collection; Contract: 35 days from sample receipt at laboratory	Cool to 4EC ±2EC

[a] Individual target metals are listed in Table 1B.

Data Calculations and Reporting Units:

Calculate the sample results according to the protocol of the appropriate instrument data system.

Report water sample results in concentration units of micrograms per liter (Fg/L), and soil sample results in concentration units of milligrams per kilogram (mg/kg) on a dry weight basis. Report percent solids to the nearest percent.

For rounding results, adhere to the following rules:
   a) If the number following those to be retained is less than 5, round down;
   b) If the number following those to be retained is greater than 5, round up; or
   c) If the number following the last digit to be retained is equal to 5, round down if the digit is even, or round up if the digit is odd.

All records of analysis and calculations must be legible and sufficient to recalculate all sample concentrations and QC results. Include an example calculation in the data package.

TABLE 1B. **Target Analyte List, CAS Numbers, and Contract Required Detection Limits for Metals by ICP-AES**

ANALYTE	CAS No.	CRDL for Water (µg/L)	CRDL for Soil (mg/Kg)
Aluminum (Al)	7429-90-5	200	40
Antimony (Sb)	7440-36-0	60	12
Arsenic (As)	7440-38-2	10	2
Barium (Ba)	7440-39-3	200	40
Beryllium (Be)	7440-41-7	5	1
Boron (B)	7440-42-8	10	2
Cadmium (Cd)	7440-43-9	5	1
Calcium (Ca)	7440-70-2	5000	1000
Chromium (Cr)	7440-47-3	10	2
Cobalt (Co)	7440-48-4	50	10
Copper (Cu)	7440-50-8	25	5
Iron (Fe)	7439-89-6	100	20
Lead (Pb)	7439-92-1	3	1
Magnesium (Mg)	7439-95-4	5000	1000
Manganese (Mn)	7439-96-5	15	3
Molybdenum (Mo)	7439-97-6	20	4
Nickel (Ni)	7440-02-0	40	8
Potassium (K)	7723-14-0	5000	1000
Selenium (Se)	7782-49-2	5	1
Silica (SiO2)	7631-86-9	100	20
Silver (Ag)	7440-22-4	10	2
Sodium (Na)	7440-23-5	5000	1000
Thallium (Tl)	7440-28-0	10	2
Vanadium (V)	7440-62-2	20	4
Zinc (Zn)	7440-66-6	10	2

Table 2A.   *Summary of Calibration Procedures for Metals by ICP-AES*

Calibration Element	Frequency	Acceptance Criteria	Corrective Action
Initial Calibration (minimum blank + 1 calibration standard) (ICAL)	Initially, Daily; whenever required, due to failure of CCV	Acceptable ICV, CRI, and ICB standards	1. Terminate analysis 2. Re-calibrate and verify before sample analysis
Initial Calibration Verification (ICV) at midpoint of ICAL (Different source from ICAL standards)	Daily, immediately following ICAL and prior to sample analysis	90-110% of expected concentration	1. Terminate analysis and identify and document problem 2. Reprep and re-analyze ICV and all associated samples 3. Re-calibrate and re-analyze reprepped ICV and all associated samples
Calibration Blank Verification (ICB, CCB)	After ICV and every CCV	< CRDL	1. Terminate analysis 2. Determine Source of contamination 3. Reprep ICB and CCB 4. Re-analyze all samples associated with a contaminated blank
Continuing Calibration Verification (CCV)	Before samples, after every 10 samples, and end of run	90-110% of expected concentration	1. Re-calibrate and verify 2. Re-analyze samples back to last acceptable CCV
Contract Required Detection Limit Verification Standard (CRI)[a]	After ICV, but before sample analysis	65-135% of expected concentration	1. Re-prep and re-analyze standard 2. Re-calibrate and verify
ICP Interference Check Samples (ICS)	Run at start and finish of daily run or twice per 8 hours	80-120% of expected concentration	1. Re-prep and re-analyze standard 2. Re-calibrate, verify, and re-analyze all associated samples

[a] The CRI standard must be between the CRDL and 2X CRDL.

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Table 3. ***Summary of Internal Quality Control Procedures for Metals by ICP-AES***

QC Element	Frequency	Acceptance Criteria	Corrective Action
Method Blank (MB)	One per batch or SDG [a, b]	< CRDL	1. If lowest sample concentration is more than 10X the blank conc., no action 2. If samples are non-detected, no action 3. If detected sample concentrations are less than 10X blank conc., all affected samples must be prepared again with another method blank and re-analyzed
Duplicate Sample (DUP)	One per batch or SDG [a, b]	**Waters:** RPD <± 20 for samples >5X CRDL; ± CRDL for samples <5X CRDL **Soils:** RPD <± 35 for samples >5X CRDL; ± 2xCRDL for samples <5X CRDL	1. Flag associated data with an "*"
Matrix Spike Sample (MS)	One per batch or SDG [a, b]	± 75-125% of expected value [c]	1. Flag associated data with an "N"
Laboratory Control Sample (LCS)	One per batch or SDG [a, b]	**Waters:** 80-120% of expected concentration **Soils:** within control limits of certified solid LCS or 80-120% of expected concentration	1. Terminate analysis and identify and document the problem 2. Re-analyze all associated samples
Serial Dilution Sample (5 X Dilution)	One per batch or SDG [a, b]	± 10% difference from original results for analyte concentrations greater than 50 times the IDL	1. Flag associated data with a "E"

ᵃ SDG - Sample Delivery Group - each case of field samples received; or each 20 field samples within case; or each 7 calendar day period during which field samples in a case are received.
ᵇ Minimum requirement is the analysis of 1 QC sample per 20 samples.
ᶜ An exception to this rule is granted in situations where the sample concentration exceeds the spike concentration by a factor of 4. In such an event, the data shall be reported unflagged.

Dilute and re-analyze samples with concentrations exceeding the linear range. Results for such re-analyses should fall within the mid-range of the linear range. Report results and submit documentation for both analyses.